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(54) HEAT SHRINKABLE THERMOPLASTIC BAG

(71) We, MOBIL OIL CORPORATION, a corporation organised under the laws of the State of New York, United States of America, of 150 East 42nd Street, New York, New York 10017, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to a bag which facilitates a method for wrapping pallet loads of goods utilizing heat shrinkable thermoplastic film, such as, for example, polyethylene. The Applicant has developed a pallet wrapping system whereby specially designed individual bags, which are formed from film stock material which has been highly oriented during its manufacture in a direction which corresponds to the width of the bag in its final form, may be employed to shrink wrap palletized loads.

In the past a wide variety of heat shrinkable thermoplastic sheet configurations, including bags, have been employed to shrink wrap palletized loads of goods. Thermoplastic bags, fabricated from continuous tubes of thermoplastic such as polyethylene, may be used for such shrink-wrap operations. For example, in the past, pallet loads have been enshrouded with plain bottom seal, ungusseted bags and the combination exposed to heat to shrink the bag about the pallet load (see Figure 8C. of the attached drawings). Such an arrangement results in unsightly ears of thermoplastic material projecting from opposite ends of the top of the pallet load. As illustrated in Figure 8B, of the attached drawings, other prior art bag structures employed for this type shrink wrap application included bottom-sealed, side-gusseted bags, and even, as shown in Figure 8A., a tube of thermoplastic, which is gathered and tied together to close one end thereof. In all of such prior art attempts, after heat shrinking of the film enshrouded pallet load, excess film material, susceptible of snagging on objects and causing the film covering to be prematurely ripped from the pallet load it protectively encases, was present.

U.S. Patent No. 3,522,688 discloses the employment of specially designed heat shrinkable thermoplastic bags for enveloping a loaded pallet. In contrast with the heat-shrinkable bags of the present invention, this patent discloses that positive restraining means such as staples or wedges are necessary to hold the open mouth portion of the heat shrinkable bag around the periphery of the base of the pallet load being overwrapped to ensure that the film material does not shrink upwardly when the overwrapped palletized load is exposed to heat thereby leaving exposed a portion of the pallet's lower extremity, rather than completely enshrouding the pallet. In the heat-shrinkable bag of the present invention such restraint is unnecessary during the heat shrink operation since, as more fully described hereinafter, the applicant has so constructed the heat-shrinkable bag as to ensure that a lesser amount of shrinkage will occur in the direction which corresponds to the height of the pallet load being overwrapped, than will occur in the direction which corresponds to the girth of the load which is being packaged.

The bag of the present invention is generally fabricated from an extruded tube that has been slit continuously along one edge thereof, the side of the tube which is slit open eventually forming the open mouth of the bag.

The invention provides a heat shrinkable thermoplastic bag formed in the collapsed condition by taking a piece of thermoplastic film comprising superposed front and rear walls which terminate at one end to form the mouth of the bag and are joined together at the opposite end in a transverse crease line which extends parallel to the bag mouth, folding a bottom portion of the bag over along a fold line parallel to said crease line to overlie a portion of the exterior surface of one wall and heat sealing the folded-over bottom por-

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tion along its opposite edges to longitudinal edges of said film, the front and rear walls of said film being also heat sealed along said longitudinal edges to define the side edges of the collapsed bag, which bag, upon exposure to heat, shrinks to a greater extent in the direction (referred to the collapsed bag) perpendicular to the longitudinal heat seals than in the direction perpendicular to the open mouth and the transverse crease line. Generally it is preferred that the fold depth be equal to about half of the width dimension of a pallet it is desired to overwrap. This fold is sealed in position by heat seals running perpendicular to the folded and slit edges of the tube. These perpendicular seals are positioned where the tube is cut to define the width of the collapsed bag, the machine direction of extrusion corresponding to the width of the bag. Since the machine direction of extrusion of the tube is the direction in which the highest degree of orientation is imparted to the film in a standard blown film extrusion operation in comparison with the tube's transverse direction, the film comprising the bag structure will shrink to a higher degree around the girth of the object being overwrapped and to a much lesser degree in the direction corresponding to the height of the object being overwrapped. Such an arrangement results in a very neat appearing overwrapped pallet load and eliminates the necessity to positively mechanically restrain shrinkage of the film in the pallet-height direction.

A method of producing a shrink wrapped package comprises (a) drawing the open mouth of the heat shrinkable thermoplastic bag of the invention over and into enveloping relationship with a substantially rectangular parallelepipedic object, or rectangular parallelepipedically arranged group of objects, until the open mouth of the bag surrounds and extends slightly below the periphery of the base of said object or group of objects and the folded-over bottom portion of the bag unfolds and conforms to the rectangular top of the object or group of objects; (b) subsequently heating said thermoplastic bag whereby said bag shrinks to encase the object or group of objects, the flat bottom portion and sides of the bag being in close contact with the top and sides, respectively, of the object or group of objects.

Brief Description of Drawings

Fig. 1 is a schematic view of a flattened section of blown tubular film employed to produce the bag of the present invention.

Fig. 2 is a schematic view of the tube illustrated in Fig. 1 having one longitudinal edge thereof continuously slit.

Fig. 3 is a schematic view of the flattened slit tube illustrated in Fig. 2 having the longitudinal edge opposite the slit edge of the tube folded over into overlying relationship with the front wall of the tube, the folded over portion and opposed transverse edges of the tube having been heat sealed together to form the finished bag.

Fig. 4 is a cross-sectional view taken on line 4—4 of Fig. 3.

Fig. 5 shows the individual bag illustrated in Fig. 3 in a fully opened, erect condition.

Fig. 6 illustrates the bag of Fig. 5 having been shrunk about a palletized load.

Fig. 7 is a schematic view, similar to Fig. 6, illustrating the direction of maximum shrink force which occurs when the bag illustrated in Fig. 5 is subjected to heat.

Figs. 8A, 8B and 8C are illustrations of prior art techniques employed to shrink wrap palletized loads.

It has been found, as hereinabove discussed, that when employing thermoplastic bags to shrink wrap a pallet load, it is desirable that the bag shrink to a greater extent in a direction which corresponds to the girth of the pallet rather than in the direction corresponding to the height of the pallet. Such controlled shrinkage insures that the pallet is tightly encased by the thermoplastic material around its perimeter or girth and also that the pallet is completely protected with the thermoplastic material throughout its entire height.

The Applicants have found that bags with the shrinkage characteristics hereinabove described may be obtained by, in addition to controlling the extrusion conditions of the tubular stock material employed to fabricate the bags, fabricating the bags in such a manner that the width of the bag structure corresponds to the machine direction of extrusion of the tubular film stock.

Fig. 1 illustrates a section of a continuous thermoplastic tube such as, for example, polyethylene which has been formed utilizing standard tubular film extrusion equipment as described in more detail in the following example. In standard tubular extrusion operations the machine direction, i.e., the direction which corresponds to the direction in which the extruded tube is travelling, is the direction in which a relatively high degree of orientation is imparted to the tube by nature of the extrusion process. This contrasts with the degree of orientation imparted to the tube in the transverse direction which is by comparison extremely low. Since the degree of orientation imparted to the tube is proportional to the amount of shrink energy which the tube exhibits when exposed to elevated temperatures the applicant has fabricated a bag wherein the width direction of the bag corresponds to the machine direction of the tubular stock from which the bag is fabricated.

As illustrated in Fig. 2 the blown tubular film stock 11 of Fig. 1 after the tube has

been flattened subsequent to the extrusion operation is continuously slit along longitudinal edge 12, the slit edge 12 eventually corresponding to the open mouth portion of the bag. Subsequent to slitting the flattened tubular film stock 11 longitudinal edge, portion 13 of tube 11 is folded over into overlying relationship with the bottom portion of the stock 11 forming new crease line 14 running parallel with slit 12. Finally, a transverse heat seal and cut off operation on the running tubular stock at spaced-apart intervals forms the final bag product, heat seals 15 defining the width of the finished bag. As shown in Fig. 5 when the bag of Fig. 3 (which is illustrated in a lay flat position) is erected to an open position the bottom fold i.e., the distance between crease lines 13 and 14 should correspond to approximately 1/2 of the width dimension of the pallet load it is desired to shrink package.

The fully open rectangular bag in Fig. 5 is subsequently placed over the top of a generally rectangular parallelepipedal shaped pallet load and drawn down over the load so that the rectangular bag bottom comes into contact with the rectangular shaped top of the load being packaged. Such an assembly is subsequently passed through a heated tunnel for example wherein the bag on exposure to heat shrinks tightly about the pallet load being packaged. The maximum direction of shrink force as illustrated by the arrow about the package on Fig. 7 is in a direction which corresponds to the girth of the pallet load being overwrapped. This ensures that the overwrapped palletized load is snugly and uniformly encased within the bag overwrap and, most importantly, since there is a minimal amount of shrink of the thermoplastic material in the direction corresponding to the height of the pallet there is a minimal tendency for the film to shrink upwards to undesirably expose to contamination the lower portion of the pallet load.

The following example of a specific method which may be employed to produce the side seal bottom folded bag of the present invention is given merely for purposes of illustration and, accordingly, should not be construed in a limiting sense.

Example

Low density polyethylene resin pellets, (density 0.918; melt index 0.5) are fed into the hopper of a standard rotating screw extruder having a L/D ratio of 25:1. Molten polyethylene is extruded from the extruder through an annular die orifice having an orifice gap of about .025 mils and a diameter of about 65 inches, at a melt temperature of about 370°F. The polyethylene tubing is extruded from the annular orifice utilizing a standard blown film extrusion technique, i.e., employment of an entrapped air bubble, and as the film is extruded it is cooled utilizing standard extrusion air cooling rings positioned around the circumference of the tubing and out of contact therewith. The blow-up ratio of the tubing intermediate the annular die orifice and a set of collapsing rollers, positioned down stream from the die, is about 1.37:1. The draw-down ratio of the tubing in the machine direction, i.e., the direction of extrusion, is about 8:1. Subsequent to passage of the now formed polyethylene tubing through the collapsing rollers the tubing is slit continuously along one longitudinal edge thereof as shown in Fig. 2 of the attached drawings. After slitting of the tubing the opposite longitudinal edge, which comprises a continuous crease, is folded over into overlying relationship with a portion of the front wall of the collapsed tube and finally a transverse heat-seal and cut-off operation occurs along spaced intervals of the slit and folded over tubing, said intervals corresponding to the desired width of the bag, to form the bag illustrated in Fig. 3. When such a bag is erected or opened, the folded portion of the bag bottom unfolds whereby a rectangular configuration of the bag-bottom, as illustrated in Fig. 5, is produced.

Such an open bag was then placed over a substantially rectangular parallelepipedal pallet load having dimensions of about 40"×48"×50". The enshrouded pallet load was subsequently passed through a heated shrink tunnel wherein it was exposed to a temperature of about 400°F. for a period of about 45 seconds. Upon emergence from the heat-shrink tunnel, the thermoplastic material tightly encased the pallet load around the girth thereof and the rectangular top portion of the pallet load was in uniform contact with the rectangular bag bottom, the entire pallet load having a very neat, smooth appearance by virtue of the uniform conformation of the shrunken bag thereto.

It will be noted as illustrated in Figs. 6 and 7 that, as the film shrinks about the lower portion of the pallet the film had a tendency to curl up and under the base of the pallet load to ensure that the film, during the shrink operation, does not pull upwardly away from the bottom of the pallet which would leave the bottom pallet portion exposed. As hereinbefore discussed, this tendency is a result of the direction of maximum shrink force in the bag of the present invention, such force being about the girth of the load being overwrapped, the bag having minimal shrink energy in a direction which corresponds to the height of the pallet.

WHAT WE CLAIM IS:—

1. A heat shrinkable thermoplastic bag formed in the collapsed condition by taking a piece of thermoplastic film comprising superposed front and rear walls which terminate

at one end to form the mouth of the bag and are joined together at the opposite end in a transverse crease line which extends parallel to the bag mouth, folding a bottom portion of the bag over along a fold line parallel to said crease line to overlie a portion of the exterior surface of the wall and heat sealing the folded-over bottom portion along its opposite edges to the parallel longitudinal edges of said film, the front and rear walls of said film being also heat sealed along said longitudinal edge to define the side edges of the collapsed bag, which bag, upon exposure to heat, shrinks to a greater extent in the direction (referred to the collapsed bag) perpendicular to the longitudinal heat seals than in the direction perpendicular to the open mouth and the transverse crease line.

2. A bag according to Claim 1 in which the thermoplastic is polyethylene.

3. A heat shrinkable thermoplastic bag substantially as herein described with reference to and as shown in Figures 1 to 5 of the accompanying drawings.

4. A method of producing a shrink-wrapped package which comprises (a) drawing the open mouth of a bag as claimed in any of claims 1 to 3 over and into enveloping relationship with a substantially rectangular parallelepipedic object, or rectangular parallelepipedically arranged group of objects, until the open mouth of the bag surrounds and extends slightly below the periphery of the base of the object or group of objects and the folded-over bottom portion of the bag unfolds and conforms to the rectangular top of the object or group of objects, (b) subsequently heating the thermoplastic bag whereby the bag shrinks to encase the object or group of objects, the flat bottom portion and sides of the bag being in close contact with the top and sides, respectively, of the object or group of objects.

5. A method of producing a shrink-wrapped package substantially as hereinbefore described and shown in Figures 1 to 7 of the accompanying drawings.

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1362145 COMPLETE SPECIFICATION
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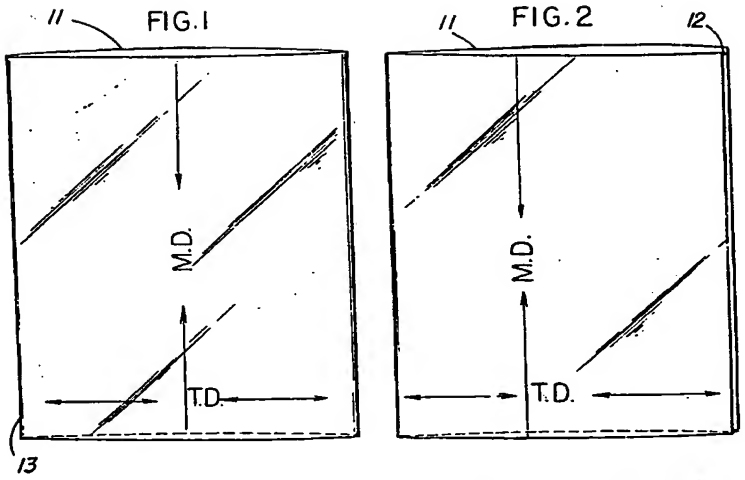

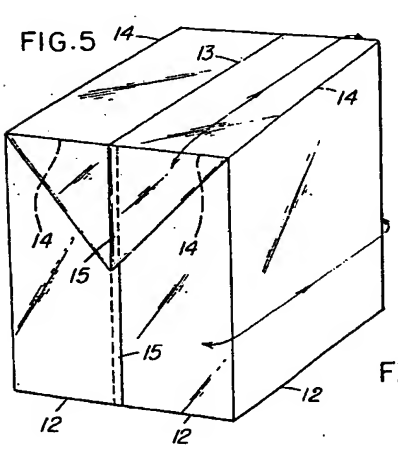

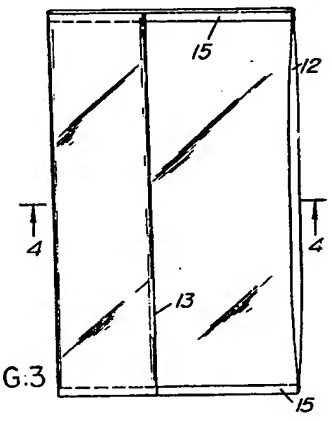

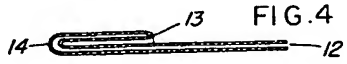

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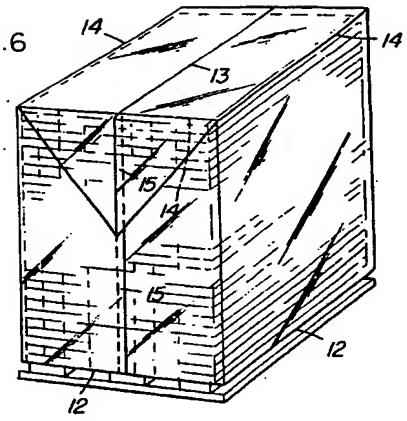
FIG.6



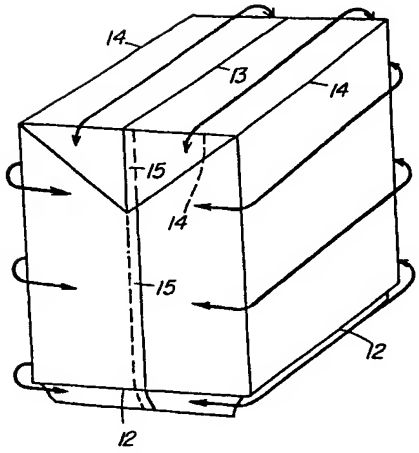


FIG.7

1362145 COMPLETE SPECIFICATION
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Sheet 3

PRIOR ART

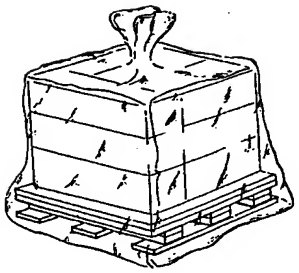

FIG.8A

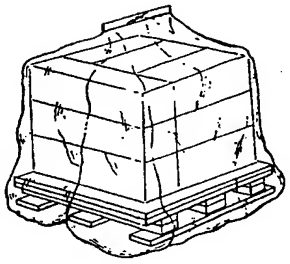

FIG.8B

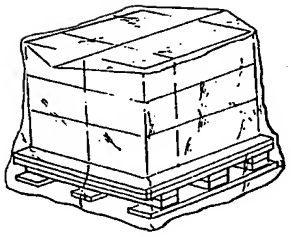

FIG.8C